§53. Probe Measurement of Boundary Plasma in QUEST

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In order to measure the boundary plasma of a spherical tokamak, a probe scanning system, as shown in Fig.1, was installed in the spherical tokamak QUEST, which has been built in the Institute of Applied Physics, Kyushu University. The scanning system can move a probe head in a distance of 500 mm horizontally inward and moved it out in a very short time, say within 1 sec, using high air pressure. Because of this fast movement of the probe head, we can easily obtain radial profiles of the probe measurements. Besides, it might enable us to make the probe measurement with many other measurements or experiments.

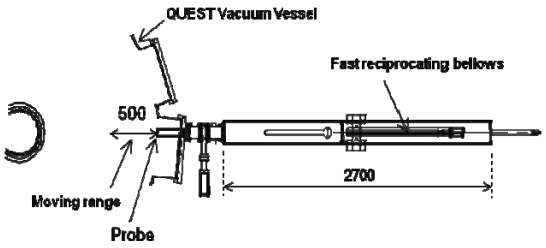

Fig. 1 Sketch of fast scanning probe system.

For this probe measurement, two types of probe heads are prepared. One is a facing-double probe, the sketch of which is illustrated in Fig. 2. Such the probe head was used to measure plasma flow velocities in the long sustained tokamak, TRIAM-1M.[1] The spatial resolution of the facing double probe is determined by its distance in the longitudinal direction, i.e., 22 mm. Since the small aspect ratio of the spherical tokamak, the uniformity of the boundary plasma along a magnetic field line is not expected and such the good spatial resolution might be necessary. The other probe head is the combination of five cylindrical electrodes as shown in Fig. 3. Three of them are placed in line at the top of an insulator wall and the other two are placed at each side of the insulator wall. The former set of the three electrodes can be used to measure plasma density, electron temperature, floating potential, and so on and may work as a triple probe. The later set of the two electrodes can measure the directional nature of the boundary plasma and may work as a conventional Mach probe.

Figure 4 shows time traces of the typical probe signals and those of Hα and 2.45 GHz ECR discharge power in QUEST.

1) Tsushima, A., Sakamoto, M., Kimura, N., Saitou, Y., and TRIAM Group, Jpn. J. Appl. Phys.**47** (2008) 8576-8578.

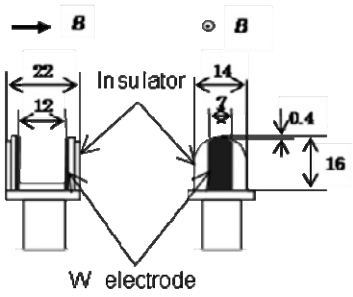

Fig. 2 Probe head as facing double probe.

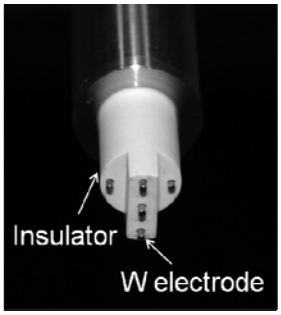

Fig. 3 Probe head with five electrodes. There electrodes at the top of insulator wall work as a triple probe and the other electrodes placed at each side of insulator wall work as a conventional Mach probe.

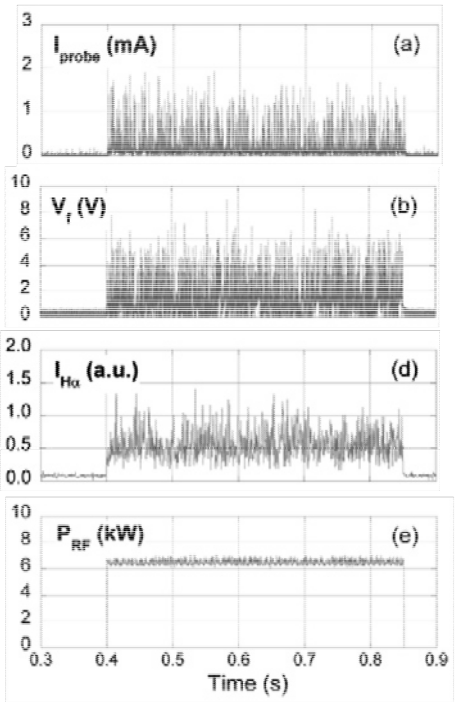

Fig. 4 Time traces of the typical probe signals and those of Hα and 2.45 GHs ECR discharge power.